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EXAMINER

NGUYEN, TU MINH

ART UNIT

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

DETAILED ACTION

1. An Applicant's Amendment filed on March 10, 2009 has been entered. Claim 17 has been amended. Overall, claims 17-19, 21-25, and 29 are pending in this application.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. **Claims 17-19, 21-25, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Katoh et al. (U.S. Patent 5,402,641) in view Ozawa et al. (U.S. Patent 5,075,276).**

Re claim 17, as illustrated in Figures 1 and 5, Katoh et al. disclose a process for purifying exhaust gas from lean burning internal combustion engines using an exhaust gas purifying catalyst (6) containing a noble metal (platinum) and a transition metal (copper) (see line 61 of column 3 to line 3 of column 4) and which removes hydrocarbons, carbon monoxide, and nitrogen oxides from the exhaust gas, comprising:

- providing a gasoline engine (2) of the carburetor type;

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- injecting gasoline into a cylinder of the gasoline engine to provide a mixture of air and gasoline having an air-fuel ratio of 13 to 15 and combusting the mixture to form an exhaust gas in a first exhaust gas state (stoichiometric or rich air-fuel ratio) having an exhaust-gas temperature in a range of 350°C to 800°C at an inlet to the catalyst (step 106 with YES answer and step 108) (in step 108, the first exhaust gas state is stoichiometric with an air-fuel ratio of 14.7); wherein the catalyst being obtained by mixing the noble metal and the transition metal with or carrying the noble metal and the transition metal by a fire-resistant inorganic oxide, the fire-resistant inorganic oxide being active alumina (line 62 of column 3);

- contacting the exhaust gas in the first exhaust gas state with the catalyst to remove hydrocarbons, carbon monoxide, and nitrogen oxides from the first exhaust gas and purify the first exhaust gas (see at least Figure 3B and lines 23-28 of column 4);

- injecting gasoline into the cylinder of the gasoline engine to provide a mixture of air and gasoline having an air-fuel ratio of more than 15 to 50 (see lines 25-26 of column 5) and combusting the mixture to form an exhaust gas in a second exhaust gas state (lean air-fuel ratios) having an exhaust-gas temperature being in a range of 200°C to 500°C at the inlet to the catalyst (step 106 with NO answer and step 110); and

- contacting the exhaust gas in the second exhaust gas state with the catalyst to remove hydrocarbons, carbon monoxide, and nitrogen oxides from the second exhaust gas and purify the second exhaust gas (see at least Figure 3A and lines 15-23 of column 4).

Katoh et al., however, fail to disclose that their engine is a gasoline fuel-direct-injection type engine which allows fuel to be directly injected inside a cylinder of the engine; and that an amount of the noble metal being in a range of 0.01 to 50 g/liter with respect to the catalyst

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volume, the fire-resistant inorganic oxide having a BET surface area of $50 \text{ m}^2/\text{g}$ to $200 \text{ m}^2/\text{g}$ and having a pore diameter of 10 nm to 30 nm.

Katoh et al. disclose the claimed invention except for applying the invention to a gasoline fuel-direct-injection type engine. It would have been obvious to one having ordinary skill in the art at the time the invention was made to apply the invention of Katoh et al. to a gasoline fuel-direct-injection type engine, since the recitation of such amounts to an intended use statement. Note that both “gasoline fuel-direct-injection engine” and “gasoline carburetor-injection engine” generate exhaust gases containing harmful emissions of HC, NO_x, soot, CO, and SO_x, that require purification before the gases can be released to the atmosphere; and the mere selection of the purification process of Katoh et al. for use in a gasoline fuel-direct-injection engine would be well within the level of ordinary skill in the art.

Ozawa et al. disclose a catalyst adapted to purify hydrocarbons, carbon monoxide, and NO_x in the exhaust gas of an internal combustion engine. As indicated on lines 15-62 of column 6, Ozawa et al. teach that their catalyst comprises a catalytically active coating having a platinum metal group and a high surface area support material. The platinum metal group is in a density range of 0.01 to 5 g/liter of the catalyst volume (see line 57 of column 6). The high surface area support material is a fire-resistant inorganic oxide (gamma alumina) having a BET surface area of $50 \text{ m}^2/\text{g}$ to $200 \text{ m}^2/\text{g}$ and having a pore diameter of 10 nm to 30 nm (300 angstrom = 30 nm) (see lines 16-20 of column 6). As depicted in Figure 2, Ozawa et al. further teach that their catalyst has relatively high purification efficiencies of HC, CO, and NO_x based on said composition of the catalyst. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the density range of platinum and the

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inorganic oxide taught by Ozawa et al. in the catalyst of Katoh et al., since the use thereof would have provided a catalyst having high efficiencies in removing HC, CO, and NO_x emissions in the exhaust gas.

Re claim 18, in the modified process of Katoh et al., the exhaust gas in the second exhaust gas state (lean air-fuel ratio) forms a more oxidizing, low-temperature atmosphere as compared with the first exhaust gas state (stoichiometric or rich air-fuel ratio).

Re claim 19, in the modified process of Katoh et al., the first exhaust-gas state (stoichiometric or rich air-fuel ratio) is a state at a time of high output of the gasoline engine of a fuel-direct-injection type, and the second exhaust-gas state (lean air-fuel ratio) is a state at a time of low output of the gasoline engine (see at least Figure 13 and lines 24-41 of column 10).

Re claim 21, in the modified process of Katoh et al., the transition metal (copper) is at least one selected from the group consisting of manganese, iron, cobalt, copper, and nickel.

Re claim 22, in the modified process of Katoh et al., the catalyst includes at least one noble metal (platinum) selected from the group consisting of platinum, rhodium, palladium and iridium.

Re claim 23, in the modified process of Katoh et al., the exhaust-gas temperature in the second exhaust-gas state (lean air-fuel ratio) ranges from 200°C to 350°C at the inlet of the catalyst.

Re claim 24, in the modified process of Katoh et al., the catalyst includes platinum and rhodium as the noble metal (see lines 65-66 of column 3).

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Re claim 25, in the modified process of Katoh et al., the catalyst includes at least one of a cerium-oxide powder and a zirconium-oxide powder (see Table 2 and lines 50-62 of column 4 in Ozawa et al.).

Re claim 29, in the modified process of Katoh et al., when the temperature of the exhaust gas at the inlet of the catalyst is higher than 500°C, the catalyst is unable to reduce NOx contained in the exhaust gas that is in the second exhaust gas state (the catalyst in Katoh et al. is unable to reduce NOx from the second (lean) exhaust gas state).

Response to Arguments

4. Applicant's arguments with respect to the references applied in the previous Office Action have been fully considered but they are not persuasive.

In response to applicant's argument that the combination of Ozawa et al. with Katoh et al. is improper because neither reference describes a direct fuel-injection gasoline engine (page 8 of the Amendment), the examiner respectfully disagrees.

The claim in the pending application that the pending invention is directed to a direct fuel-injection gasoline engine has been determined as an "intended use statement". The examiner has noted that most internal combustion engines (which includes the engine in the pending application and the lean burning engine in Katoh et al.) that utilize a hydrocarbon source as a fuel generate exhaust gases containing harmful emissions of HC, NOx, soot, CO, and SOx, that require purification before the gases can be released to the atmosphere; and the mere selection of the purification process of Katoh et al. for use in a direct fuel-injection gasoline engine would be well within the level of ordinary skill in the art.

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Moreover, the purification process in Katoh et al. is applied to an engine capable of running at lean air-fuel ratios (see the Abstract). Since Katoh et al. did not limit their process to a specific hydrocarbon fuel, it is at least obvious to one with ordinary skill in the art that their process is also applied to a gasoline engine that is known to be capable of running at a lean air-fuel ratio. Katoh et al., however, fail to specifically mention that their gasoline engine is a direct injection type. Even if the engine in Katoh et al. is a carburetor type, the examiner maintains that such engine still generates exhaust gases containing harmful emissions of HC, NO_x, soot, CO, and SO_x, that require purification before the gases can be released to the atmosphere; and the mere selection of the purification process of Katoh et al. for use in a direct fuel-injection engine would be well within the level of ordinary skill in the art.

In response to applicant's argument that the combination of Ozawa et al. with Katoh et al. is still improper because Katoh et al. fail to teach or suggest i) an exhaust gas that is purified at the claimed temperature ranges, and ii) the claimed air-fuel ratios that are specified at the claimed temperature ranges (page 11 of the Amendment), the examiner again respectfully disagrees.

As pointed out in paragraph 3 above, the examiner has shown in Figure 5 that Katoh et al. clearly disclose or teach the steps of providing a mixture of air and gasoline having an air-fuel ratio of 13 to 15 and combusting the mixture to form an exhaust gas in a first exhaust gas state (stoichiometric or rich air-fuel ratio) having an exhaust-gas temperature in a range of 350°C to 800°C at an inlet to the catalyst (step 106 with YES answer and step 108) (in step 108, the first exhaust gas state is stoichiometric with an air-fuel ratio of 14.7); and providing a mixture of air and gasoline having an air-fuel ratio of more than 15 to 50 (see lines 25-26 of column 5) and

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combusting the mixture to form an exhaust gas in a second exhaust gas state (lean air-fuel ratio) having an exhaust-gas temperature being in a range of 200°C to 500°C at the inlet to the catalyst (step 106 with NO answer and step 110). Thus, Katoh et al. clearly disclose or teach the claimed limitations in dispute.

Conclusion

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

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Communication

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Tu Nguyen whose telephone number is (571) 272-4862.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Thomas E. Denion, can be reached on (571) 272-4859. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Tu M. Nguyen/

TMN

Tu M. Nguyen

June 5, 2009

Primary Examiner

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